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SYMPATHETIC SIDEBAND COOLING OF CaH^+

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We demonstrate sympathetic Doppler cooling and our progress towards sideband cooling of a CaH^+ ion co-trapped with a Ca^+ atomic ion in a linear Paul trap. Molecular ions are generally difficult to laser cool due to a lack of closed electronic transitions as a result of vibrational and rotational states. Despite this challenge, they can be cooled indirectly through their Coulombic interaction with a fluorescent atomic ion that is being directly laser cooled. Ions are firstly Doppler cooled to get to the Lamb-Dicke regime, where the ion motion is small relative to the excitation wavelength and then sideband cooled reaching temperatures below 1 μK. All the ions' axial modes (center of mass and breathing mode) and radial modes (two center of mass and two tilt modes) are addressed, and the temperature is determined by examining the ratio of sidebands.